

1 CLAIMS

2 What is claimed is:

- 3 1. An optical apparatus, comprising:
4 a planar waveguide substrate;
5 a micro-hermetic cavity formed on the waveguide substrate;
6 a planar transmission optical waveguide formed on the waveguide substrate for
7 enabling optical power transfer between an interior volume of the micro-
8 hermetic cavity and a volume exterior thereto; and
9 means for sealing the micro-hermetic cavity.
- 10 2. The apparatus of Claim 1, wherein the micro-hermetic cavity and the transmission
11 optical waveguide are formed concurrently using a common material processing
12 sequence.
- 13 3. The apparatus of Claim 2, wherein material forming the micro-hermetic cavity
14 comprises at least one of core material and cladding material, the core material and
15 the cladding material used to form the transmission optical waveguide.
- 16 4. The apparatus of Claim 1, further comprising:
17 multiple transmission optical waveguides formed concurrently on a common
18 substrate wafer; and
19 multiple corresponding micro-hermetic cavities formed concurrently on the common
20 substrate wafer,
21 wherein division of the substrate wafer results in multiple individual waveguide
22 substrates having thereon at least one of the transmission optical waveguides
23 and the corresponding micro-hermetic cavity.
- 24 5. The apparatus of Claim 1, the sealing means comprising a lid sealed around a
25 perimeter of the micro-hermetic cavity, thereby separating the interior volume
26 thereof from the volume exterior thereto.
- 27 6. The apparatus of Claim 5, the micro-hermetic cavity formed from core material and
28 cladding material, the core material and cladding material also forming the
29 transmission optical waveguide, and the core material and cladding material that

1 form the micro-hermetic cavity vertically arranged in substantially the same manner
2 as the core material and cladding material that form the transmission optical
3 waveguide, thereby forming a substantially flat upper surface around the perimeter
4 of the micro-hermetic cavity for sealing the lid.

5 7. The apparatus of Claim 5, wherein material deposited over at least a portion of the
6 transmission optical waveguide forms a substantially flat upper surface of the
7 perimeter of the micro-hermetic cavity for sealing the lid.

8 8. The apparatus of Claim 1, further comprising at least one optical device assembled
9 onto the waveguide substrate within the micro-hermetic cavity so as to enable
10 optical power transfer between the optical device and the transmission optical
11 waveguide.

12 9. The apparatus of Claim 8, the sealing means comprising a lid sealed around a
13 perimeter of the micro-hermetic cavity, the optical device formed on the lid, the lid
14 serving as a device substrate, sealing the lid onto the micro-hermetic cavity serving
15 to position the optical device so as to enable optical power transfer between the
16 optical device and the transmission optical waveguide.

17 10. The apparatus of Claim 8, the lid being adapted for conveying signals between the
18 optical device and the volume exterior to the micro-hermetic cavity.

19 11. The apparatus of Claim 1, wherein the transmission optical waveguide is adapted
20 for reducing optical loss induced by the presence of the micro-hermetic cavity.

21 12. The apparatus of Claim 11, further comprising a reflective coating formed on an
22 upper surface of that portion of the transmission optical waveguide that intersects a
23 perimeter of the micro-hermetic cavity.

24 13. The apparatus of Claim 11, further comprising a thickened upper cladding layer
25 formed on that portion of the transmission optical waveguide that intersects a
26 perimeter of the micro-hermetic cavity.

27 14. The apparatus of Claim 11, further comprising an upper core and a lower core
28 formed within the transmission optical waveguide, the upper and lower cores
29 separated by cladding material, the upper core contained within the micro-hermetic

1 cavity, the lower core enabling optical power transfer between the interior and
2 exterior volumes of the micro-hermetic cavity, the upper and lower cores positioned
3 for transverse-transfer of optical power therebetween within the micro-hermetic
4 cavity.

5 15. The apparatus of Claim 1, the sealing means comprising an embedding medium at
6 least partly filling the micro-hermetic cavity.

7 16. A method comprising:
8 forming a micro-hermetic cavity on a planar waveguide substrate;
9 forming a planar transmission optical waveguide on the waveguide substrate for
10 enabling optical power transfer between an interior volume of the micro-
11 hermetic cavity and a volume exterior thereto; and
12 sealing the micro-hermetic cavity.

13 17. The method of Claim 16, wherein the micro-hermetic cavity and the transmission
14 optical waveguide are formed concurrently using a common material processing
15 sequence.

16 18. The method of Claim 16,
17 wherein multiple transmission optical waveguides are formed concurrently on a
18 common substrate wafer,
19 wherein multiple corresponding micro-hermetic cavities are formed concurrently on
20 the common substrate wafer, and
21 further comprising dividing the substrate wafer into individual waveguide substrates
22 having thereon at least one of the transmission optical waveguides and the
23 corresponding micro-hermetic cavity.

24 19. The method of Claim 16, wherein a lid sealed around a perimeter of the micro-
25 hermetic cavity is employed for sealing the optical device within the micro-hermetic
26 cavity.

27 20. The method of Claim 16, further comprising assembling at least one optical device
28 onto the waveguide substrate within the micro-hermetic cavity so as to enable

- 1 optical power transfer between the optical device and the transmission optical
- 2 waveguide.
- 3 21. The method of Claim 16, further comprising adapting the transmission optical
- 4 waveguide for reducing optical loss induced by the presence of the micro-hermetic
- 5 cavity.
- 6 22. The method of Claim 16, further comprising at least partly filling the micro-hermetic
- 7 cavity with an embedding medium, thereby sealing the micro-hermetic cavity.